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P. V. Tupik, PhD (Agriculture), senior lecturer (BSTU);
A. V. Mantitskaya, master's degree student (BSTU)

INVESTIGATION OF PROPERTIES AND SOWING QUALITIES OF FOREST SEEDS OF EUROPEAN LARCH

The paper dwells upon size-quality characteristics of cones and sowing qualities of European larch seeds harvested from different plantations (forest cultures and seed plantation), their age being different. As a result of the investigation it has been identified that qualitative and quantitative characteristics of European larch forest seeds harvested from forest and seed plantations show no considerable differences. A significant difference has been found for sowing qualities of seeds. It has been stated that with increasing age the seed germination increases from 0–20% (biological age of 8 years) to 34.5–35.6% (biological age of 10 years). The paper gives some recommendations on European larch cones harvesting taking into account its biological features.

Introduction. At present the Ministry of Forestry of the Republic of Belarus attributes great attention to creating and growing of European larch forest plantations. Main part of seeds to grow planting material is purchased abroad as a permanent forest seed establishment is underdeveloped in Belarus, however the area of seed plantations is constantly increasing covering over 37.0 ha, of which 2.5 ha is certified. All seed plantations are created with due account for achievements of forest selection that makes it possible to obtain seeds of valuable hereditary character and of high sowing qualities. Many of them have already reached seeding age and are therefore not only of practical but also of scientific interest to investigate quantitative and qualitative characteristics of forest seeds and their sowing qualities.

The object-matters of the present study were seed plantation of European larch of generative origin, collection plantations, alley plantations of European larch and common forest plantations (Table 1).

The age of European larch trees on the study area is 8 years in the seed plantation and alley plantation (biological age is 10 years) and 6 years in forest and collection plantations (biological age is 8 years).

It should be noted that it is this biological age (7–8 years) when European larch starts producing seeds. At this age cones appear in small quantities on individual trees.

In the following years the seeding wealth and the number of seed-producing trees gradually increase. The average height of trees in the plantation is 7.3 m, the average diameter is 15,8 cm, the crown breadth is 3.6 m.

The average height of trees in the alley plantation is 7.5 m, the average diameter is 12.5 cm, the crown breadth is 2.4 m; in the collection and forest cultures the average height is 5.5 and 5.1 m respectively, the average diameter is 6.0 and 7.3 cm respectively, the crown breadth is 2.5 and 2.7 m respectively.

Thus, the objective of our study was to investigate properties and sowing qualities of forest seeds harvested from different selection areas growing in Belarus.

Main part. According to literary sources the cones of European larch get ripe in late summer – early autumn. The length of an average cone varies from 2–4 (6) cm. After seeds drop out, the cones remain on a tree for several years [1]. This biological feature should be taken into consideration when harvesting forest seeds of European larch as mistaken harvesting of last year's cones can reduce quality of the harvested seeds.

Table 1

Characteristics of the study areas

Number of variant	Forestry enterprise	Forest station	Plantation type	Age (biological age of trees), years	Quantity of seed-producitng trees, %	Average characteristics of trees in the study areas		
						height, m	diameter, cm	crown breadth, m
1	Negoreloye	Centralnoye	Collection plantation	6 (8)	26.8	5.5	6.0	2.5
2		Centralnoye	Alley plantation	8 (10)	7.3	7.5	12.5	2.4
3	Ivye	Ivye	Forest cultures	6 (8)	8.9	5.1	7.3	2.7
4	Starobin	Krasno-slobodskoye	Seed plantation	8 (10)	15.4	7.3	15.8	3.6

Table 2

Characteristics of forest seeds of European larch of different harvesting periods

Variant	Cone length, mm	Cone width, mm	Cone weight, g	Seed quantity in a cone, pcs.	Weight of 1000 seeds, g	Seed output per cone, %	Quantity of seed dropped out of a cone during drying, %	Laboratory similarity of seeds, %
Last year's cones	25.9 ± 2.0	16.2 ± 0.6	1.49 ± 0.23	37 ± 5.9	5.44 ± 0.74	13.2 ± 0.8	46.5 ± 7.6	0
Current year's cones	31.8 ± 0.9	17.5 ± 0.6	2.58 ± 0.22	54 ± 2.5	5.20 ± 0.24	11.4 ± 0.7	33.5 ± 6.0	14.4 ± 1.6

Table 2 shows size-quality parameters of cones and sowing qualities of current year's and last year's seeds harvested at the same time in collection plantations. As it can be seen from the table, last year's seeds don't germinate. They contain a smaller quantity of seeds that the current year's cones because some of their seeds dropout in winter and in summer. However, both types show no large difference in weight of 1000 seeds and in seed output.

The main distinctive feature of current year's seeds by which they differ from the last year's ones is the colour of scales. Last year's cones have a tarnished brown scales colour while those of the current year are of light brown colour. Besides, the scales of last year's cones are more turned up than those of the current year.

Harvesting of European larch cones is recommended in sunny weather, several days after rainfall because wet cones are all similar in colour and turning-up of scales so this can lead to harvesting a large quantity of last year's cones.

After drying of cones collected in autumn and winter, their seeds hardly drop out. This can be explained by the fact that they are heavily resin-soaked at this time, their scales closely fit each other that's why their harvesting is recommended to be done in winter [1, 2]. As we can see from our table, the quantity of seeds dropped out of last year's cones when drying is 46.5%. This proves the fact that the harvesting time of forest seeds does not solve the problem completely and calls for some more effective techniques to be searched. For instance, Polish researchers apply the following technique: to foster the dropout of European larch seeds from the cones they repeatedly wet forest seeds and dry them afterwards. Eight wet-dry cycles are recommended to achieve complete dropout of seeds [3].

Table 3 summarizes the results of defining different characteristics of seeds and their sowing qualities. The check plantation to analyze the table is seed plantation. The quantity of seeds in a cone varies from 43 to 54 by variants, the weight of 1000 seeds varies from 4.95 to 5.66 g, the output of seeds varies from 9.1 to 12.3%, the dropout of seeds when drying varies from 18.4 to 40.2%.

We have not identified any significant difference in the presented characteristics between variants. Therefore we can conclude that qualitative and quantitative characteristics of European larch forest seeds of the analyzed biological age (8–10 years) show no difference when harvested from forest plantation and seed plantation.

However, characteristics of sowing qualities of seeds show an essential difference. So, germination and germinating power of seeds from seed plantation are significantly higher than those of collection plantation of Negoreloye forestry station and forest cultures of Ivye forestry enterprise.

Besides, seeds from Starobin forest plantation germinated earlier than the others that proves the average seed resting period to be 6.4 days. A little later seeds from alley plantation (the average seed resting period is 7.4 days) and those from forest cultures of Ivye forestry enterprise (the average seed resting period is 9.0 days) started germinating.

Table 3

Characteristics and sowing qualities of European larch forest seeds

Variant	Quantity of seeds in a cone, pcs.	Weight of 1000 seeds, g	Seed output per cone, %	Quantity of seed dropped out of a cone during drying, %	Germination, %	Germinating power, %	Average seed resting, days
Collection plantation	54 ± 3	5.20 ± 0.24	11.4 ± 0.7	33.5 ± 6.0	14.4 ± 1.6	3.6 ± 0.95	11.8 ± 0.52
Alley plantation	50 ± 6	5.66 ± 0.13	10.0 ± 0.6	18.4 ± 6.9	34.5 ± 3.0	24.5 ± 2.22	7.4 ± 0.19
Forest cultures	54 ± 3	5.14 ± 0.19	12.3 ± 0.5	30.2 ± 6.1	8.9 ± 1.1	4.2 ± 1.03	9.0 ± 0.73
Seed plantation	43 ± 6	4.95 ± 0.30	9.1 ± 1.1	40.2 ± 8.4	35.6 ± 7.0	31.4 ± 6.70	6.4 ± 0.30

The seeds from collection plantation of Negoreloye forestry station (the average seed resting period is 11,8 days) were the last ones to germinate. Thus, we can conclude thatin contrast to size-quality characteristics of seeds, their sowing qualities differ considerably depending on the age of the trees: the plantations of 10-year biological age (seed and alley plantations) germination of seeds and their germinating power are several times higher than similar characteristics of plantations of 8-year biological age. This conclusion is also proved by our earlier investigations. Then we studied seed plantation of Starobin forestry enterprise and alley plantation of Negoreloye forestry station. The biological age of trees was 8 years at that time, the seed germination equaled 0% in the seed plantation (now 34.5%) and 20% in the alley plantation (now 35.6%).

Conclusion. Thus, as a result of investigation it has been identified that in Belarus harvesting of European larch seeds can be done at the 8-year biological age, though sowing qualities of seeds can be not that high. Our investigation has revealed the seed germination ranging from 0 to 20%. The best characteristics have been discovered in the seed plantation as it has the most effective cross-pollination conditions and a favourable light regime thus promoting a large quantity of male and female reproductive organs. The germination of seeds increases with increasing age. In our case seed germination was 34.5–35.6% at the age of 8 years (biological age was 10 years), what is more this characteristic showed no significant difference between alley and seed plantations. Seed plantation proved to be superior to forest plantationonly in the starting time of seed germination. It should be noted as well that qualitative and quantitative characteristics of European larch forest seeds harvested from seed and forest plantations at the analyzed biological age (8–10 years) reveal no considerable differences. When harvesting cones it should be taken into account that the European latch trees may have last year's cones in them and such cones do not give germinating seeds. Harvesting of European larch cones is recommended in sunny weather, several days after rainfall because wet cones are all similar in colour and turning-up of scales so this can lead to harvesting a large quantity of last year's cones.

References

11. Лиственница в Беларуси: научно-техническая информация в лесном хозяйстве / Н. К. Крук [и др.]; М-во лесн. хоз-ва Респ. Беларусь, РУП «Белгипролес». Минск, 2006. 95 с.

2. Царев А. П., Погиба С. П., Тренин В. В. Селекция и репродукция лесных древесных пород. М.: Логос, 2003. 520 с.

3. Filipiak M., Tylkowski T. Population and individual variation in the process of seed release by cones of European larch. // Silvae genet. 2003. Vol. 52, № 5–6. P. 281–286.

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